LOADING DEVICE FOR A SEMI-AUTOMATIC RIFLE

The present invention relates to a loading device for semi-automatic rifles. In particular, the present invention relates to a self-compensating loading device for semi-automatic rifles operated by a part of the gases created by the gunpowder combustion.

There are known systems for the arming of semi-automatic rifles in which a portion of the gases created by the gunpowder combustion is drawn from the chamber in the rifle barrel. This gas portion is recovered and sent to a loading device that converts, through a piston and a cylinder, the gas pressure to kinetic energy, i.e. in a movement of the piston itself.

This movement of the piston is used for operating the arming mechanism of the rifle itself.

The Applicant has observed that depending on the type of cartridge, in particular the type of charge contained by the cartridge, the quantity of the gas given off by the combustion varies. Therefore, the gas pressure generated by the combustion caused by a light charge cartridge is lower than that generated by the combustion caused by a heavy charge cartridge. As a result, the thrust induced on the piston by the gas under pressure varies according to the type of

cartridge fired, and in the case of combustion caused by a heavy charge cartridge there may be too much thrust with respect to the actual rearming requirement, and such thrust may cause excessive stress on the arming mechanism elements of the rifle. Moreover, in the case of combustion caused by a light charge cartridge, the thrust caused by the gas under pressure may be insufficient for the correct functioning of the arming mechanism. Generally, the system is not very flexible and hardly functional when using cartridges at the upper or lower limit of the charge range.

In order to overcome such a drawback, the known technique proposes the use of a higher-than-necessary recovered gas quantity to operate the arming mechanism with light charge cartridges, while the presence of valves to make excess gas flow out of the piston is expected whenever heavy charge cartridges are used.

The Applicant has observed that the valve-based, gas-quantity regulation systems require frequent cleaning since gases created by the combustion have passed through them, as have hence their residual products in order to function sufficiently.

Moreover, also known are valve-less regulation systems achieved without valves but provided with springs placed under the piston thrust surface, which with its compression absorbs part of the excess thrust energy.

The Applicant has also observed that the energy absorbed by the spring is subsequently returned, however, in the direction opposite to that of absorption and therefore on the arming mechanisms, still causing considerable and uncomfortable stresses and hence the sensation of recoil on the rifle is not attenuated in an effective manner.

Moreover, absorption or regulation systems are known which are made with a "double-face" piston which, in a first condition optimises the piston for weak charges and in a second condition optimises the piston for strong or heavy charges.

The system as conceived is not optimised for the numerous types of commercially-available cartridges and is also problematic, in that the selection of the two conditions occurs manually by operating the suitable selection means, in particular if it is desired to fire mixed rounds of diverse cartridges.

The Applicant has affronted the problem of making a simple and efficient device for the arming of semi-automatic rifles, actuated by a portion of the gas given off by the combustion caused by the cartridge shot. Moreover, the Applicant has addressed the problem of making the device efficient for each type of cartridge fired, from cartridges containing weak charges to those with strong charges.

The Applicant has produced a self-compensating loading device for semi-automatic rifles, in which the generated thrust from the recovered gases from the combustion caused by the cartridge fired, is rendered of a sufficient quantity for the correct rifle rearming, by way of an toroidal, elastomeric body adapted to absorb the excess thrust when strong or heavy charge cartridges are fired and not to interfere when weak or light charge cartridges are fired.

One aspect of the present invention regards a loading device for a semi-automatic rifle, in which said rifle comprises a barrel in which a cartridge may be inserted, operable by a loading and firing mechanism; said device comprises a piston, slidable over a gas cylinder of said rifle which operates said loading and firing mechanism and is actuated by a recovered portion of the gases generated by the combustion of the charge contained in the cartridge, characterised in that it comprises a compressible and deformable toroidal, elastomeric body capable of transmitting to said piston the thrust generated by said recovered gas portion in a thrust chamber.

Further objects and advantages of the present invention shall be clear from the following description and from the attached drawings, given as an example and not for limiting purposes, in which:

- figure 1a depicts a side and partial section view of a semi-automatic rifle's central area with the loading device highlighted according to an embodiment of the present invention;
- figure 1b is an enlargement of a portion of the rifle of figure 1a, which comprises part of the loading device;
- figure 2 depicts the same rifle of figure 1 after a shot, with the path of the gases originating from the combustion highlighted in particular.
- figure 3a depicts the rifle portion of figure 1b after a shot from a weak cartridge;
- figure 3b depicts the rifle portion of figure 1b after a shot from a strong cartridge.

With reference to the cited figures, a semi-automatic rifle, of the type illustrated in figure 1, comprises a barrel 2 in which a cartridge 3 is inserted, operated by a loading and firing mechanism 4.

The firing mechanism is actuated in a *per se* known manner by a trigger 5 to which a firing pin 6 is associated.

According to the present invention the rifle also comprises a loading or arming device for said loading and firing mechanism 4, which determines a weapon reloading each time a cartridge is fired, in order to obtain a repeating rifle.

Said loading device is of the gas recovery type: gases are drawn away from the rifle barrel 2 once a cartridge has been fired by way of a hole made on said barrel connected to a channelling 7.

Said loading device comprises a cylindrical body 8, joined at one of its ends to a support 9 and connected to said barrel 2, inside of which lies said channelling 7. Inside of the cylindrical body a sleeve 10 is inserted, slidable over a gas cylinder 11 attached to the rifle's butt 14.

At the sleeve 10 end facing the firing mechanism 4 there is an annular portion 101, which is associated to a piston 12, the which is connected to the firing mechanism 4.

The opposite end of said sleeve is associated with a control ring 17 maintained in contact with the sleeve through an elastic ring 18, which determines the thrust surface for the gases coming from the channelling 7.

Between the sleeve 10 and the cylinder 8, according to the present invention, the arming device comprises a toroidal, elastomeric body 20 which is attached between the control ring 17 and the annular portion 101 and encloses said sleeve. The piston 12 is slidable over said gas cylinder 11 and is maintained in contact with said sleeve 10 by way of an annular spring 15, enclosing said gas cylinder, and blocked at one of its

ends by a shoulder 16 of said rifle butt 14. In such a manner the sleeve 10 transmits the movement to the piston 12.

The loading device according to the present invention operates as follows.

While the weapon is locked, the spring 15 maintains the piston 12 in "stand-by" position; in such configuration with the cartridge 3 inserted in the barrel 2 the weapon is ready to fire.

Figure 2 illustrates the rifle after a shot has been fired, with the gas G generated by the combustion of the charge contained in the cartridge highlighted in particular. A portion of said gas, as is more clearly indicated in the following figures, is introduced into the channelling 7 in a thrust chamber S, delimited by the control ring 17 by the outer surface of the gas cylinder 11 and by the walls of the support 9.

The gas under pressure pushes on the control ring 17, which transmits the pressure to the toroidal, elastomeric body 20, which in turn pushes the sleeve 10 and as a result causes the piston 12 to move. The piston movement activates the loading and firing mechanism 4, which causes the rearming of the rifle.

Figures 3a and 3b illustrate how the loading device operates with a light cartridge (Fig. 3a) and a heavy cartridge (Fig. 3b), respectively.

In particular, a light cartridge causes, in the thrust chamber S, the down flow of a gas quantity so to compress the toroidal, elastomeric body without substantially deforming it, in accordance with its deformation characteristics. Therefore, the sleeve 10 is put into motion with the force sufficient to activate the loading and firing mechanism 4 by way of the piston 12. Thus for a light cartridge substantially all of the force of the gas under pressure is transmitted to the piston 12.

A heavy cartridge causes, in the thrust chamber S, a down flow of a higher quantity of gas with respect to that generated by a light cartridge and therefore a potentially greater thrust on the piston 12.

Subjected to a greater thrust, the toroidal, elastomeric body tends to compress itself, deforming its diameter as illustrated in figure 3b.

The compression of the toroidal body absorbs part of the gas energy, the deformation of its diameter causing friction against the inner wall of the cylinder 8. Such friction further diminishes the effect of the thrust on the sleeve 10 and on the piston 12, in such a way that the piston itself is provided with the necessary thrust to properly activate the loading and firing mechanism, analogous to that which occurs for a light cartridge.

The material used to make the toroidal body is chosen

so that it has suitable shape, hardness, and elasticity to obtain a proper effect of thrust absorption from a minimum thrust for light charges to a maximum thrust for heavy charges.

The device of the present invention allows the achievement of considerable efficiency in the operation of semi-automatic rifles for a remarkable range of different cartridges, in fact it reduces the velocity gap of the kinematisms between light and heavy charges, reduces the violent impacts caused by cartridges with heavy charge and, not insignificantly, reduces the uncomfortable physical sensation of the recoil on the user.

Moreover, the various parts of the loading device do not require frequent maintenance.